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AF Academy students build satellite for 2003 launch

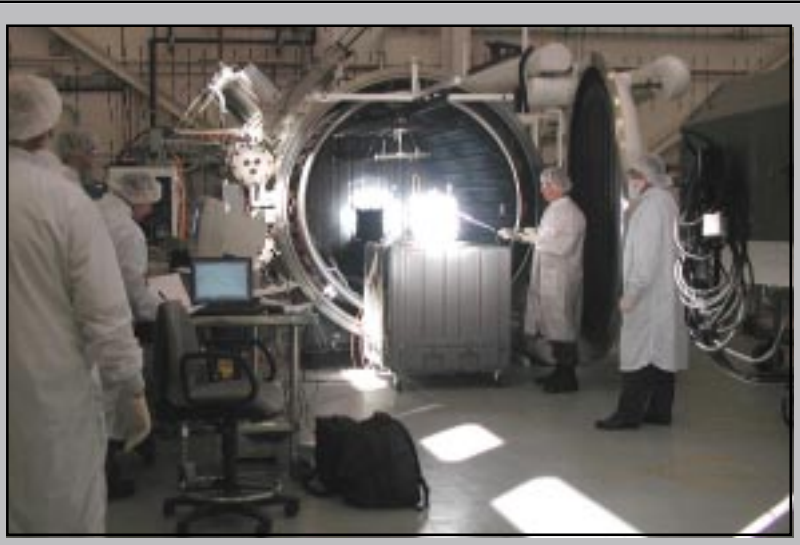
by John Brownlee, Space Vehicles Directorate

KIRTLAND AFB, N.M. – "There is no substitute for experience." That is what a team of dedicated U.S. Air Force Academy students and faculty answer when asked why they are temporarily assigned here at the Air Force Research Laboratory's (AFRL) Space Vehicles Directorate.

They are building a satellite to be launched from the Space Shuttle in early 2003 that will study naturally occurring changes in the ionosphere that impair communications between orbiting spacecraft and ground stations.

"We are using AFRL's aerospace engineering facility to test a prototype of our FalconSat II satellite to see how well it withstands the simulated heat, cold, and vacuum of space," said Cadet Christopher Charles, a third-year academy physics major.

"To put it simply, we learn about space by 'doing' space, and actual hands-on experience is a major component of our engineering coursework," Charles added. "You can read engineering books all day long, but until you actually get in the clean room with the satellite hardware and conduct the required tests, you will not learn as much—or as fast."



END OF THE TUNNEL - Cadet Todd Patterson "light" tests FalconSat II solar panels for proper function. AFRL vacuum chamber in the back ground simulates harsh space conditions.

FalconSat II, a 12.5-inch cube weighing about 46 pounds, with its payload approved by the Defense Department's Space Experiments Review Board, is one in a series of student-built satellites at the academy in the last few years and the product of a rather unique institution. Unlike any other undergraduate college or university, Air Force Academy students not only build and test their own satellite, they work with the academy's physics and astronautics departments to design one with an important scientific mission ultimately beneficial to the operational Air Force.

"And this, of course, interests AFRL, whose mission is to create affordable technology for the warfighter," said Colonel Jack Anthony, head of AFRL's Space Vehicles Integrated Experiments Division and former academy faculty member.

"Student programs such as FalconSat II prepare young future officers to join the Air Force space team, and many opportunities await them here at AFRL and at the Space and Missile Systems Center (SMC). "We are only too happy to host the cadets and offer our facilities. We know from experience that many of today's students will one day return to become part of our AFRL space team. It is a perfect arrangement where everyone wins—especially the Air Force," he said.

"In the past year, about 35 cadets have worked on FalconSat II," said Lieutenant Colonel Jerry Sellers, Director of the Academy's Small Satellite Research Center who oversees the cadets.

"Our program is two-fold," he said. "We educate cadets and future space leaders, and we do that by giving them a hands-on opportunity. At the same time, we provide a research platform for the Air Force. FalconSat II meets both those requirements. And thanks to financial support of AFRL's Air Force Office of Scientific Research, and SMC's Space Test Program, FalconSat II is a reality rather than merely a two-dimensional theory on a classroom chalkboard."

Scientific payload on board the academy's satellite will consist of sensors that detect "plasma bubbles" in the earth's ionosphere.

"Roughly, plasma bubbles are a little like the air bubbles in your Jacuzzi bath at home—you cannot see through the water

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when the air is bubbling through it," said Dr. Linda Krause, academy physics professor and FalconSat II science advisor.

"It's about the same with plasma bubbles in the ionosphere—you can't communicate through them," Krause explained.

"Hopefully, our science mission will enable a better understanding of the limitations posed by plasma bubbles in the ionosphere and how crucial communications are disturbed. Eventually, we hope to predict when communication outages are likely to happen. Then we can reroute communications to other satellite systems not affected by that particular outage and avoid the disrupted area," she added.

Ideally, in terms of science gathering and technology demonstration, FalconSat II will confirm whether tiny, lightweight, inexpensive sensors with very low power requirements—attached to the skin of any satellite—can collect information from many points in the ionosphere and download it to a broad database.

"If so, we could then stick our little 'smart skin' sensors on all kinds of satellites with other missions and still collect from multiple data points in the ionosphere," said Jim White, FalconSat II technical advisor of Colorado Satellite Services, Denver, Colorado, who works closely with the cadets.

"Scientific problems like plasma bubbles lead to engineering solutions that, in this case, begin at the most basic Air Force level of study—the Academy. We show cadets what problems the Air Force must overcome in terms of mission obstacles that are scientific in nature, then give the students an opportunity to work on them before they begin their careers in uniform," he said. @